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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,039	10/19/2005	Joseph P. Kenney JR.	GRA26 007	4714

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Mark C Comtois
Duane Morris
1667 K Street N W
Suite 700
Washington, DC 20006

EXAMINER	
LEE, JOHN J	
ART UNIT	PAPER NUMBER
2618	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/531,039	KENNEY ET AL.	
	Examiner	Art Unit	
	JOHN J. LEE	2618	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,10 and 18* is/are rejected.

7)☒ Claim(s) *3-9,11-17 and 19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/29/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1, 2, 10, and 18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Raleigh et al. (US Patent No. 6,144,711) in view of Motoyasu et al. (Japanese Patent Application No. 05-135996 or Publication 06-347529).

Regarding **claim 1**, Raleigh teaches that in a method for estimating the multi-path delays in a signal received at an antenna array of k antenna elements (Fig. 14 and column 1, lines 66 – column 2, lines 63, where teaches providing two or more substantially independent communication channels even in the presence of severe multipath and relatively poor physical antenna radiation pattern performance). Raleigh teaches that estimating an impulse response at each k antenna, generating a space-time impulse response (Fig. 4, 6 and column 11, lines 65 - column 12, lines 53, where teaches estimating the channel impulse response in the duration in symbol periods of the significant portion of the channel impulse response at various multipath (antennas) processing a space-time impulse response of RF), forming a covariance matrix and resolving the covariance matrix with a known antenna array (Fig. 17, 18 and column 20, lines 31 – column 21, lines 62, where teaches forming covariance matrix and significant averaging of the receive covariance matrix results in a good estimate of the transmit

covariance), the improvement comprising the step of resolving the covariance matrix with a fictitious antenna array manifold (Fig. 17, 18 and column 21, lines 16 – column 22, lines 37, where teaches significant simplification occurs when the interference covariance matrix is determined and significant averaging of the receive covariance matrix results in a good estimate of the transmit covariance, even though instantaneous channel reciprocity does not hold).

Raleigh does not specifically teach of [known antenna array] manifold, [the improvement comprising the step of resolving the covariance matrix with a fictitious antenna array] manifold (note that brackets are used for clarity in language and that it is believed these limitations are addressed by the above cited reference).

In a related art dealing with multi-path mitigation, Motoyasu teaches of [known antenna array] manifold (paragraphs 0025 and 0029), [the improvement comprising the step of resolving the covariance matrix with a fictitious antenna array] manifold (paragraphs 0025 and 0029).

It would have been obvious to one skilled in the art at the time of invention to have included into Raleigh's signal processing system, Motoyasu's measuring concepts, for the purposes of interference reduction (brought about from radio multi-paths) as taught by Motoyasu.

Regarding **claims 2 and 18**, Raleigh teaches that a method and system for estimating the multi-path delays *t* in a signal using a spatially blind antenna array (Fig. 14 and column 1, lines 66 – column 2, lines 63, where teaches providing two or more substantially independent communication channels even in the presence of severe

multipath and relatively poor physical antenna radiation pattern performance) comprising k arbitrary antenna elements (Figure 6 and column 11, lines 44 -53). Raleigh teaches that the steps of generating an impulse response h_k for each antenna element k in the antenna array (Figure 6 and column 11, lines 42 – column 12, lines 31, where teaches estimating the channel impulse response in the duration in symbol periods of the significant portion of the channel impulse response at various multipath (antennas) processing a space-time impulse response of RF). Raleigh teaches that determining a vectorized space-time impulse response I over the antenna array (Fig. 4, 6 and column 12, lines 17 - column 12, lines 53, where teaches determining space-time impulse response ($I(k)$) over the antenna array), creating a covariance matrix C (Fig. 17, 18 and column 20, lines 31 – column 21, lines 62, where teaches forming covariance matrix and significant averaging of the receive covariance matrix results in a good estimate of the transmit covariance), creating a fictitious array A_f, wherein A_f is spatially blind and independent of the array characteristics (column 21, lines 21 –33, Fig. Fig. 14, and column 30, lines 9 – 67, where teaches creating array is blind channel estimation techniques); and resolving the covariance matrix C with the fictitious A_f to thereby estimate the multi-path delays t independent of the array characteristics (Fig. 17, 18 and column 21, lines 16 – column 22, lines 37, where teaches significant simplification occurs when the interference covariance matrix is determined and significant averaging of the receive covariance matrix results in a good estimate of the transmit covariance).

Raleigh does not specifically teach of [creating a fictitious array] manifold [A_f] and [resolving the covariance matrix C with the fictitious] manifold [A_f] (note that

brackets are used for clarity in language and that it is believed these limitations are addressed by the above cited reference).

In a related art dealing with multi-path mitigation, Motoyasu teaches of [creating a fictitious array] manifold [*Af*] (paragraphs 0025 and 0029) and [resolving the covariance matrix C with the fictitious] manifold [*Af*] (paragraphs 0025 and 0029).

It would have been obvious to one skilled in the art at the time of invention to have included into Raleigh's signal processing system, Motoyasu's measuring concepts, for the purposes of interference reduction (brought about from radio multi-paths) as taught by Motoyasu.

Regarding **claim 10**, Raleigh and Motoyasu teach all the limitation as discussed in claims 1 and 2. Furthermore, Raleigh further teaches that the steps of deriving channel impulse response estimates $h_{j,k}$ for each block j at each antenna k (Figure 6 and column 11, lines 42 – column 12, lines 31, where teaches estimating the channel impulse response in the duration in symbol periods of the significant portion of the channel impulse response at various multipath (antennas) processing a space-time impulse response of RF), determining a vectorized aggregate space-time impulse response I for each block j (Fig. 4, 6 and column 12, lines 17 - column 12, lines 53, where teaches determining space-time impulse response (*I(k)*) over the antenna array). Raleigh teaches that forming an estimated covariance matrix for the sequence of j blocks (Fig. 17, 18 and column 20, lines 31 – column 21, lines 62, where teaches forming covariance matrix and significant averaging of the receive covariance matrix results in a good estimate of the transmit covariance), providing an array A_f void of spatial information (column 21, lines

21 –33, Fig. Fig. 14, and column 30, lines 9 – 67, where teaches creating array is blind channel estimation techniques), and resolving the covariance matrix with the array manifold A_f to determine the multi-path delays t (Fig. 17, 18 and column 21, lines 16 – column 22, lines 37, where teaches significant simplification occurs when the interference covariance matrix is determined and significant averaging of the receive covariance matrix results in a good estimate of the transmit covariance).

Raleigh does not specifically teach of [providing an array] manifold [void of spatial information] (note that brackets are used for clarity in language and that it is believed these limitations are addressed by the above cited reference).

In a related art dealing with multi-path mitigation, Motoyasu teaches of of [providing an array] manifold [void of spatial information] (paragraphs 0025 and 0029).

It would have been obvious to one skilled in the art at the time of invention to have included into Raleigh's signal processing system, Motoyasu's measuring concepts, for the purposes of interference reduction (brought about from radio multi-paths) as taught by Motoyasu.

Allowable Subject Matter

3. Claims 3-9, 11-17, and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art record fails to disclose the limitation" the impulse response estimate h_k is determined from the equation formulas having Z is a delay matrix and r_k is the

column vector of the received signal at antenna element k of the antenna array, and the fictitious array manifold Af is used to form the space-time manifold and the space-time manifold operates to resolve the multi-path delays, and the covariance matrix C to determine multi-path delays t uses the method of Multiple Signal Classification (MUSIC) techniques" as specified in the claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Heath, Jr. et al. (US 6,298,092) discloses Method of Controlling Communication Parameters of Wireless System.

Gesbert et al. (US 6,377,819) discloses Wireless Communication System Using Joined Transmit and Receive Processing.

Information regarding...Patent Application Information Retrieval (PAIR) system... at 866-217-9197 (toll-free)."

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks
Washington, D.C. 20231
Or P.O. Box 1450
Alexandria VA 22313

or faxed (571) 273-8300, (for formal communications intended for entry)

Or: (703) 308-6606 (for informal or draft communications, please label "PROPOSED" or "DRAFT").

Hand-delivered responses should be brought to USPTO Headquarters, Alexandria, VA.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **John J. Lee** whose telephone number is **(571) 272-7880**. He can normally be reached Monday-Thursday and alternate Fridays from 8:30am-5:00 pm. If attempts to reach the examiner are unsuccessful, the examiner's supervisor, **Edward Urban**, can be reached on **(571) 272-7899**. Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-4700.

J.L
January 6, 2007

John J Lee

EDWARD F. URBAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600